CNS/ATM for Naval Aviation

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Purpose

This newsletter provides information to the Naval aviation community on civil initiatives in Communications, Navigation and Surveillance / Air Traffic Management (CNS/ATM).

COMMUNICATIONS

Frequency Management

Voice communication architecture can be puzzling. One of the more challenging pieces of the National Airspace System (NAS) puzzle is the assignment of frequencies. The FAA's Office of Spectrum and Policy has that challenge.

First, let us review some background. The frequency band reserved for aviation runs from 108 MHz to 137 MHz with the 108 to 117.975 portion mostly reserved for landing systems and navigation ground aids. The remainder of this VHF band is for communications.

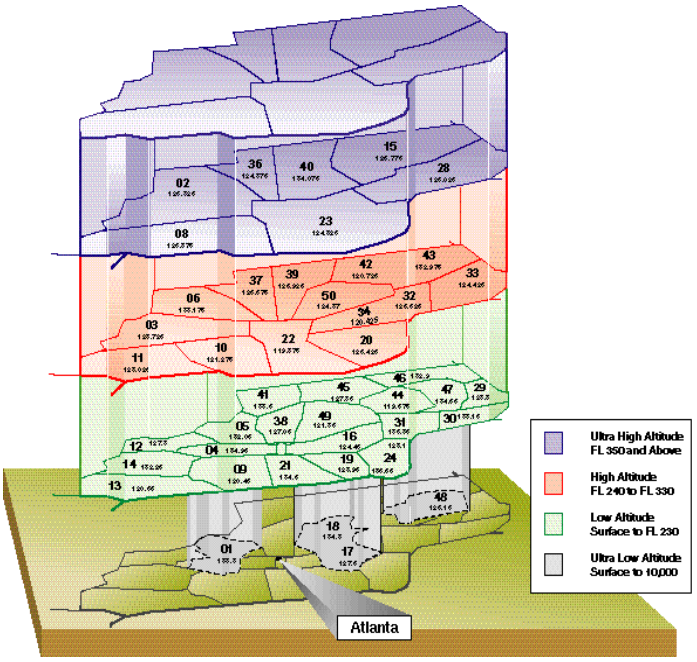
Over time, as demand increased, the spacing of voice channels went from 100 kHz to 50 kHz and then to 25 kHz. Like DOD, some civilian operators, including those in General Aviation, do not use the latest radios. For aviation safety, the FAA serves those users by reserving appropriate frequencies. However, this limits the number of dedicated 25 kHz channels.

Other demands also limit the number of channels. The "guard" channel and the Search And Rescue channel are two known to aviators. Ground operations require the use of frequencies. Frequencies are also set aside for user purposes such as communication with airline operation centers, in-flight entertainment, and so forth.

One more item to consider is co-site interference. Co-site interference occurs when two or more transmitters operate from the same location and on adjacent or nearly adjacent frequencies. The use of widely spaced transmit frequencies lessens co-site. Another technical consideration is the line-of-sight (LOS) distance of an antenna from the transmitter. A distant strong transmission on a frequency can interfere with a nearby weak signal. Before a frequency can be assigned, an assessment of potential interference is necessary.

Despite the recent slowdown, increasing demand continues to exert pressure on the existing NAS capacity. A good description of the problem and the FAA's plans to solve the problem can be found in their Operational Evolution Plan (OEP), available at www.apo.data.faa.gov/dirplans/.

One OEP way to increase capacity and reduce "choke points" is to add sectors. Another OEP way to increase NAS capacity is to add more runways. One airport adding a runway is Atlanta. The figure below shows how the sectors are defined around Atlanta.



From the figure, it can be seen there are forty-six sectors. Each sector requires the assignment of a VHF frequency that does not cause interference with all other LOS sectors. Sectors at the lower altitudes also require the availability of VHF voice channels for operators not equipped with the latest radios. The figure does not show the numerous General Aviation airports around Atlanta. Each airport requires at least one VHF frequency.

As can be seen, adding a sector requires an analysis of the NAS and adjacent international airspace. The addition of a runway also requires careful analysis. A new runway may require the use of five to seven additional frequencies. Each new frequency assignment requires that no interference exist.

One solution to capacity restraints may be adding more frequencies. Getting additional frequencies allocated to aviation is not supported by other industries. Another way to gain frequencies would be to further reduce the spacing of voice channels. Europe chose this method by introducing 8.33 kHz channel spacing. Due to co-site and LOS interference, this action does not triple the number of available channels.

Another way is to increase the number of simultaneous users. Time Division Multiple Access (TDMA) technology was selected by ICAO as the preferred method to ease the frequency problem. A four "channel" TDMA digital scheme is used in VHF Data Link - Mode 3 (VDL-3). Again, due to co-site and LOS interference, this does not quadruple the number of available channels. Analysis indicates an increase of just 2.8, but this is 33% higher than the 8.33 scheme.

VDL-3 is the technology selected for the FAA's next generation air-ground communications system (NEXCOM). Due to its development cycle, NEXCOM will not be operational until 2009. Last year, the airlines and others within the industry requested that the choice be reopened. They suggested that a combination of 8.33 for voice and VHF Data Link - Mode 2 (VDL-2) be substituted. Their suggestion was based upon three factors. The increasing need for NAS capacity may not wait until 2009. Due to European mandates, they were already equipped with 8.33. Their business case for NEXCOM did not show a rapid return on investment.

The NARC (NEXCOM Aviation Rulemaking Committee) analyzed the choice, and issued a series of recommendations. Information from the FAA's Office of Spectrum and Policy and others led to a NARC recommendation to continue with VDL-3 development with 8.33 as a fall back position.

Spectrum and Policy showed that it was using a variety of management techniques to satisfy demand. These included reclaiming unused or under-used frequencies, switching some ground-based users to alternative frequencies outside the aviation band, and looking at co-site interference mitigation techniques. One NARC recommendation was specifically aimed to these actions:

> "Continue to aggressively manage frequency assignments to prolong the useful life of the 25 kHz channel allocation in support of Air Traffic Services (ATS). Conduct an annual assessment to confirm that there will be an adequate number of 25 kHz communications frequencies to meet future capacity needs. This assessment should have at least a 5-year outlook to provide adequate warning of 25 kHz frequency spectrum depletion. "

The previous discussion focused on activities in managing frequencies within the VHF band. Some DOD aircraft are equipped only with UHF radios. Therefore, each sector also requires the availability of a UHF frequency for safe flight operations. A similar assessment for UHF interference is necessary before assigning the UHF frequency.

CNS/ATM NEWS

RVSM Notification Eased

Non RVSM compliant aircraft were required to provide advanced notification of at least 24 hours when flying in the Oakland, Anchorage, Tokyo, and Naha airspace. This requirement has now been waived, effective immediately.

Near Term CNS/ATM Mandates

The table below summarizes recent and near term CNS/ATM mandates.

CNS/ATM		
What	**Where**	**When**
RVSM	Western Atlantic Traffic Route System (FL290-410)	1 November 2001
RVSM	Australia (FL290-410)	1 November 2001
RVSM	Europe (FL290-410)	24 January 2002
RVSM	North Atlantic (FL290-410)	24 January 2002
RVSM	South Atlantic (FL290-410)	24 January 2002
RVSM	Western Pacific & South China Sea (FL290-410)	21 February 2002
RVSM	Northern Canada (FL290-410)	18 April 2002
RVSM	China & Hong Kong (FL290-410)	31 October 2002
8.33 kHz channel spacing	Europe (FL245 & up)	31 October 2002

See previous newsletters for the nations implementing the mandate for Europe and South China Sea areas.